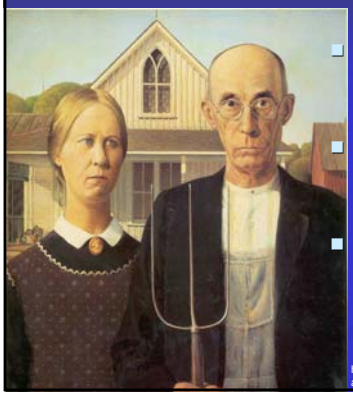
Rain Gardens : Gardens as Tools for on-site Stormwater Management

March 2009

Not tools FOR the garden...



- Stormwater management at the site level
- Stormwater as a site amenity in its own right
- Rain Gardens empower the gardener!

https://www.concordiacrusaders.org/uploaded/faculty/karners/Wood_-_American_Gothic.jpg

The Garden as a Tool

- About the Rainscapes Rewards program
- Urban Hydrology and why we need new stormwater tools
- Site Assessment
- Rain Garden Design
  - Placement
  - Sizing
  - Plant selection
- Plants
- Construction
- Maintenance

The RainScapes Program
Getting to the Source

- Residential Urban Stormwater Management
  - Reduce Runoff Volume
  - Reduce Pollutants from Neighborhoods
  - Recharge Groundwater and Stream Baseflow

- Water Conservation and Habitat Diversity
  - Native Landscapes
  - Harvesting and Reuse

- Empowering Individual Actions

RainScapes Rewards & Targeted Neighborhoods Initiatives

- **County Incentive Funding**
  - Rebate Program
  - Targeted Subwatershed Approach
  - Grants to Watershed Organizations
- This year, targeted neighborhoods are in the Lower Rock Creek and the Anacostia
  - Ken-Gar *
  - Wheaton Woods *
  - Town of Chevy Chase (Coquelin Run)
  - Stoneybrook-Parkside
  - Long Branch *
  - Sligo Creek (targeted subwatershed)
  - Hollywood Branch Glen Echo Heights

- Initiate projects with commercial / institutional sectors

Incentive Program

$/year from WQPF

- RainScapes Rewards
  - **$1,200** per residential lot; with project caps, up to:
    - $1200 for rain gardens, permeable paver retrofits, green roofs
    - $500 for turf removal conservation landscaping (min. 500 sq.ft.)
    - $200 for tree canopy
    - $50 for rain barrel (max 4)
  - Commercial/Institutional: $.50 cents per sq.ft. of imp. area treated, up to $5000 per property (2009 application to be available soon)
- Targeted RainScapes Neighborhoods (more degraded watersheds)
  - **$2200/lot** – contractors to install, County to fund all or portion of installation costs with project caps.

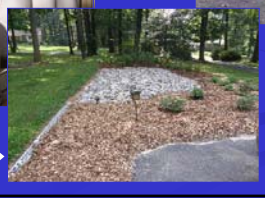
RainScapes Techniques

A wide range of natural drainage options with varying levels of rebate rewards available

- Rain Gardens
- Downspout Diversion
- Rain Barrels, Cisterns (water re-use)
- Permeable Pavers
- Green Roofs
- Soil Reconditioning and Amendment
- Native/Naturalized Landscaping
- Urban Tree Canopy

Rain Gardens for Rainscapes Rewards

$1,200 rebate available per residential property*

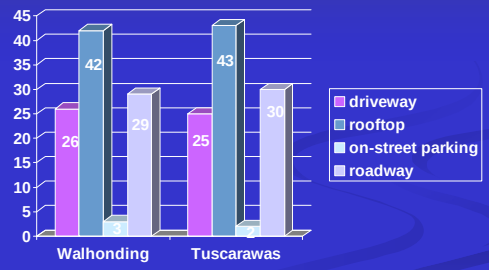


* May cost more than $1200

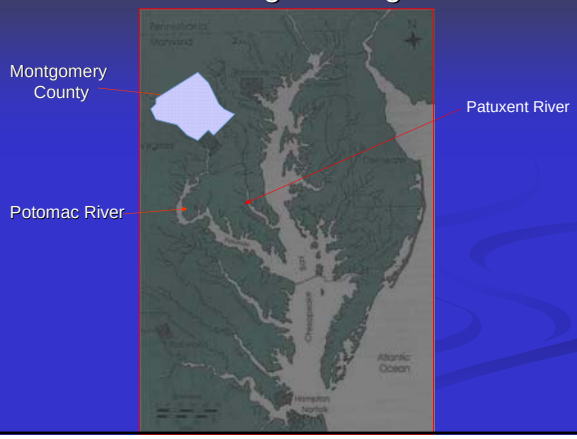
Rooftops

In typical urban residential areas, rooftops account for 30-40% of the total impervious area

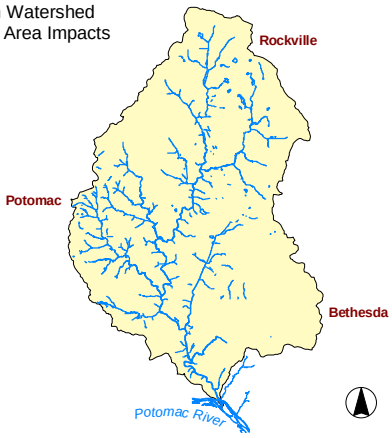
Neighborhood Impervious Cover



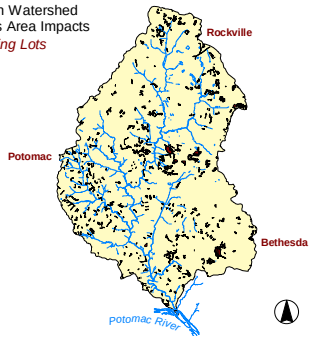
Local and Regional Significance



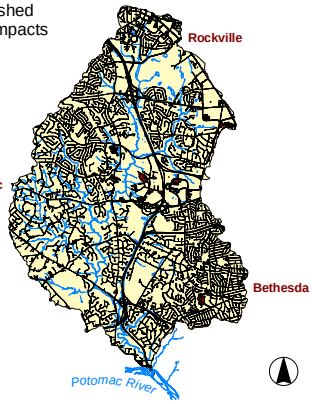
Cabin John Watershed
Impervious Area Impacts



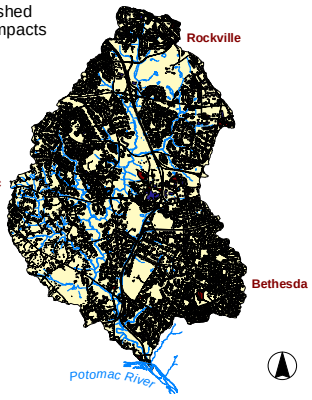
Cabin John Watershed
Impervious Area Impacts
Parking Lots



Cabin John Watershed
Impervious Area Impacts
Parking Lots
Roads

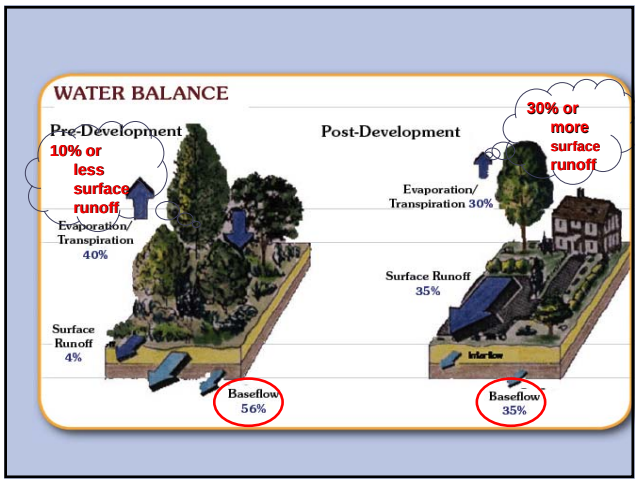


Cabin John Watershed
Impervious Area Impacts
Parking Lots
Roads
Buildings



Our own impervious surfaces are part of the problem

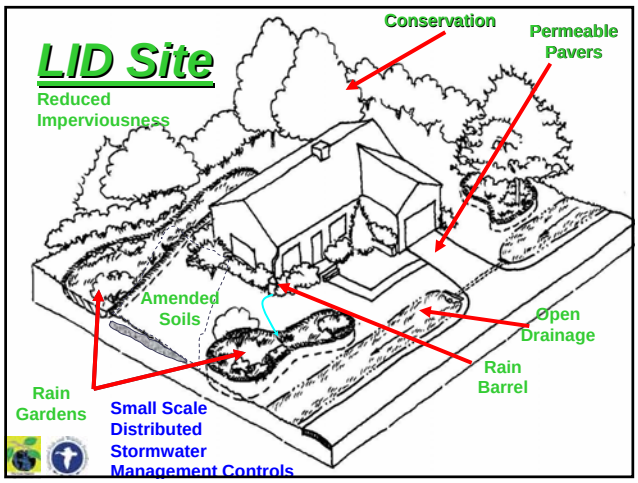
- Water flowing off a roof can reach 140°F
- Unchecked runoff pollutes, causes erosion


WATER BALANCE
Pre-Development
10% or less surface runoff
Evaporation/ Transpiration 40%
Surface Runoff 4%
Baseflow 56%
Post-Development
30% or more surface runoff
Evaporation/ Transpiration 30%
Surface Runoff 35%
Interflow
Baseflow 35%


Water emerges at a high velocity through storm sewer systems.


Urban runoff impacts
Northwest Branch
Threats to Infrastructure
Agricultural Land in Middle Hawlings


Why now?
Stormwater is a large source of pollution to the Chesapeake Bay
Rain gardens are a way to remove pollutants from the stormwater
Residential Lot In Olney
Most Common Erosion Problem
Sloughing of Vertical Banks



Rain Gardens: EPA approved retrofit!

Low Impact Design (LID)

Rain Gardens provide Low Impact Design (LID) Source control Stormwater Management

- LID = preserve and restore predevelopment hydrology
- LID Toolbox
  - Permeable Pavement
  - Site Fingerprinting
  - Maintain Natural Flow lines
  - Rain Gardens and Bioretention
  - Decentralized source controls
  - Many more!

Rain Gardens remove nutrients AND…

… remove between 80% and 85% of "suspended solids" from stormwater. This improves the quality of the water.

Types of Rain Gardens

- Underdrained
  - Impervious subsoils (*e.g.* heavy clay)
  - Water volume that exceeds garden capacity to process the water
  - Contaminated soils surrounding the garden
- Self-Contained*
  - Garden is sized to handle the volume of storm water from a typical rain storm and to infiltrate the water on-site

*RG Templates & RainScapes Gardens are generally assumed to be self-contained

Rain Garden –Two Structural Components

1) Catchment and delivery methods

Sloped sheet flow

Swale

2) Bioretention area sized for runon volume

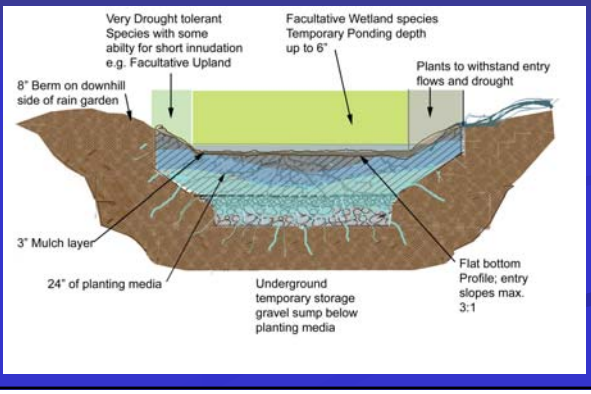
Planting area

Depth varies

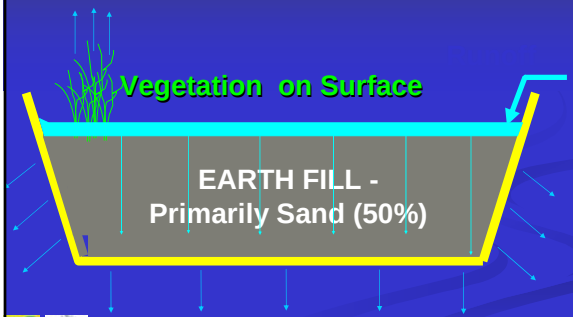
Ponding area

Bowl shaped on the surface; edges are 6-8" above garden level

Rain Garden Section



Bioretention Schematic



What soils are in a rain garden?

Rainscapes Soil specification is for a very fast draining soil:

- 50% sharp washed sand (ASTM-33)
- 25% topsoil (max. 10% clay content)
- 25% organics – typically well aged compost or may be shredded pine (no fines) – RainScapes uses LeafGro

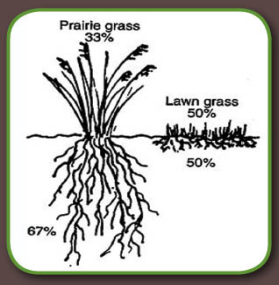
Rain Gardens exemplify a "right plant in the right place" philosophy

- The place is engineered to meet water treatment needs
- A rain garden provides beauty as well as water volume reductions and quality benefits

Plants which do best

- Deep rooted
- Able to handle extreme moisture conditions (very wet and very dry)
- These are typically:
  - Facultative Wetland
  - Facultative Upland

Value of Using Native Plants



Deeper roots – absorbs more water

Uses no fertilizer

Uses little or no pesticides

Does not require watering after establishment

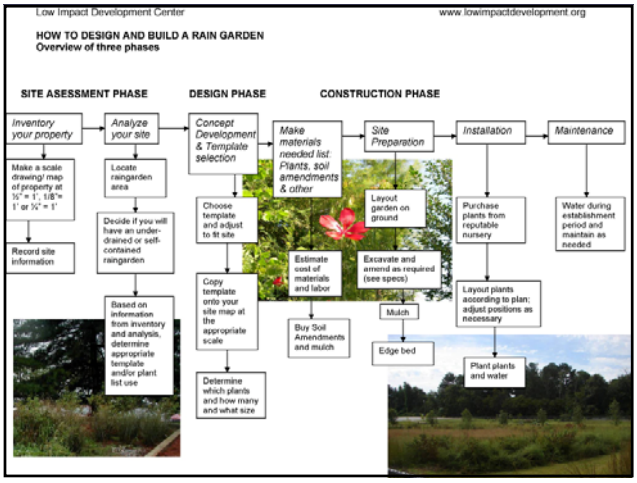
Question: Where Can I Build a Rain Garden?

Steps to a Rain Garden

- Assessment
- Design
- Construction
- Maintenance

Steps to a Rain Garden

- Select a site
- Do a soil test
- Determine how runoff is going to get into the garden
- Determine your volume of water
- Locate where your garden will be
- Determine your garden size (sf/ depth)
- Select a design template /develop a design
- Locate your utilities (Call before you dig!)
- Excavate
- Add soil amendments
- Buy and layout the plants
- Plant the garden
- Mulch with 3" of mulch
- WATER!
- Maintain



Assess your site

- Map your property
- Include water sources and problem areas
- Identify local ordinances which may apply

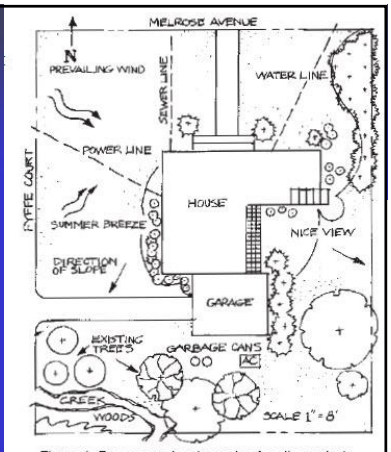
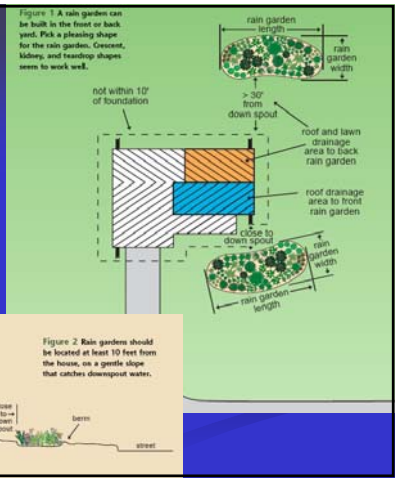


Figure 1. Base map showing notes for site analysis.

Placement guidance

Place your garden between runoff source and destination

We want to intercept water before it reaches surface waters or low spots!



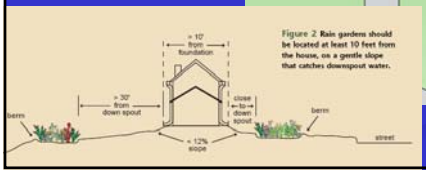
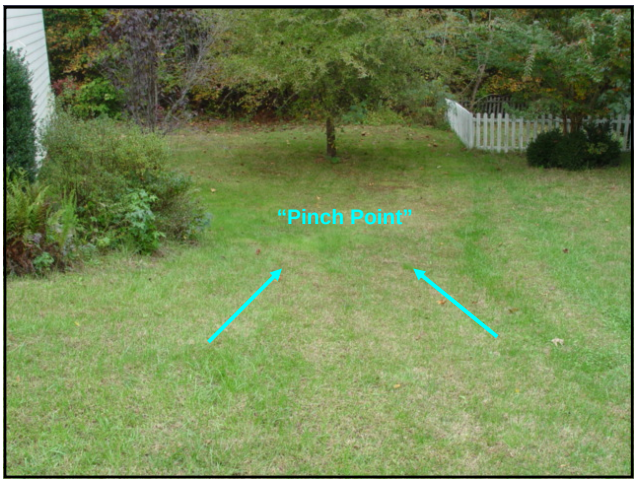


Figure 2 Rain gardens should be located at least 10 feet from the house, on a gentle slope that catches downspout water.

How is water going to get to my rain garden?

- Look at your site and look for drainage patterns – where is it high or low?
- How steep is my site?
- Roof runoff direction?



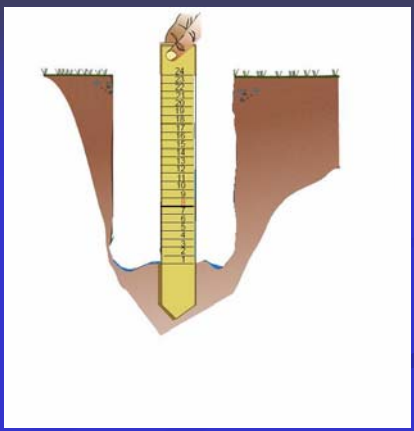
Siting Considerations

- Miss Utility 1-800-257-7777
  http://www.missutility.net/
  - Does not mark private lines or house connections
  - 10' +/- error
  - Cable lines very shallow
- At least 10' from house and down-gradient from foundations and 25' from septic fields
- At least 15' from adjacent property lines
  - If additional flow is being redirected to the rain garden, must ensure that the overflow path is adequate and clear, and does not create a lot-to-lot drainage issue
- No more than ½ acre drainage area to the garden

Soil test on your own

•Fill the 2' deep hole

•It should have drained completely in 24-36 hours



Soil Evaluation

Soils and Drainage

- Signs of an impermeable soil
  - Ponding water
  - Wetland soils – grey with areas of brown color
  - Water remains after two days of no rainfall

Design as a Backyard Wetland!

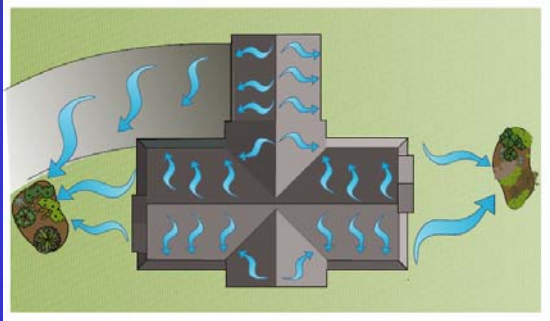
Sizing the Rain Garden

How big?
Sizing the rain garden

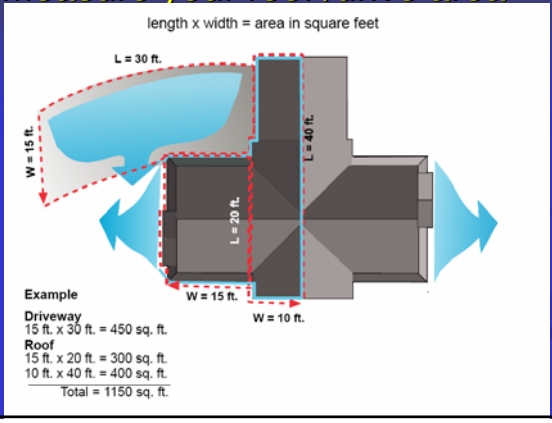
It depends…….

- How big is the drainage area (roof, lawn)?
- How deep will you dig?
- What are the surrounding soils?

Calculate the drainage area
Note the directions of flow



Measure your roof /drive area



Capture the water from a 2.7" rain storm (24 hour period) **Rule of thumb**

- Calculate your drainage area in sf
- Assume you are excavating 2' of depth and adding bioretention media
- RainScapes uses a 20% area rule of thumb X sf

Drainage sf X .20% = RG sf (if 2' deep media) with 6" ponding area needed to capture your

1150 sf X .20 = 230 sf

RainScapes rain gardens size

- The target is to capture between 1.25" and 2.7"
- Why?
  - the typical rainstorms in this area

Annual volume of water held in a RG with 24” of rain garden soil mix and 6” ponding depth (30”)

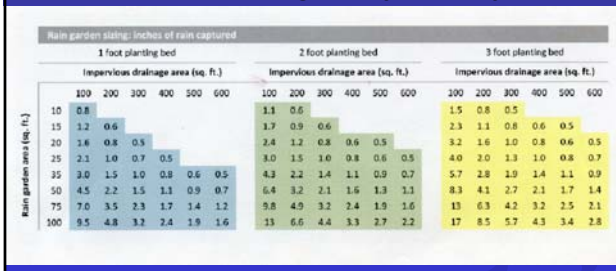
A 230 sf garden for 1150 sf of drainage will capture 90% of the water volume in poorly draining soils and 100% in well-draining soils

Size of rain garden (as a percent of imprevious area and measured in square feet)	Annual volume of water held in rain garden for poor-draining soils	Annual volume of water held in rain garden for well-draining soils
10%	70%	99%
20%	90%	100%
50%	99%	100%
80%	100%	100%

If the depth of the rain garden is increased to 30 inches* on poor-draining soils, then you can reduce the square foot area by 5% and hold the same amount of water. On well-draining soils depth does not significantly increase how much water the rain garden can hold.

* 24 inches of rain garden soil mix and a 6-inch ponding depth (30 inches total).

Sizing Chart – Calibrated for Montgomery County, MD



“1 foot planting bed” refers to planting media depth; all assume 6” of ponding

The numbers in the colored area indicate inches of rain captured/ treated/ SF of RG at a particular depth

Call before you dig!

- Miss Utility

  1-800-257-7777

  http://www.missutility.net/

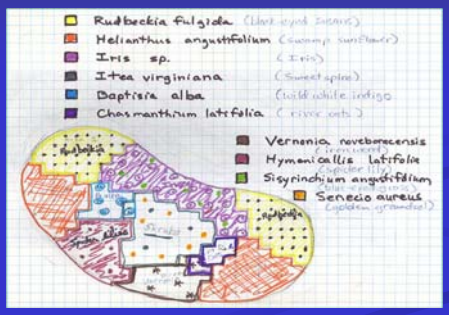
For sizing and digging examples:

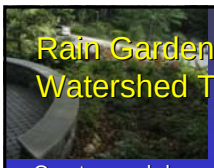
http://www.npsnj.org/rain_garden_home.htm

http://clean-water.uwex.edu/pubs/pdf/home.rgmanual.pdf

http://www.pierce.wsu.edu/Water_Quality/LID/Raingarden_handbook.pdf

Rain Garden Designs





Rain Gardens for the Chesapeake Bay Watershed Template Project

- Create a web-based tool for use by gardeners at home, garden clubs, master gardeners, landscape contractors, and landscape architects throughout the Bay watershed.
- Create an on-line clearinghouse of rain garden information: www.lowimpactdevelopment.org/raingarden_design
- Create a demonstration rain garden at Brookside Gardens in Wheaton, MD

Templates for Rain Gardens for the Chesapeake Bay Watershed

15 Designs, 3 Provinces, Sun and Shade options


Mountains


Piedmont

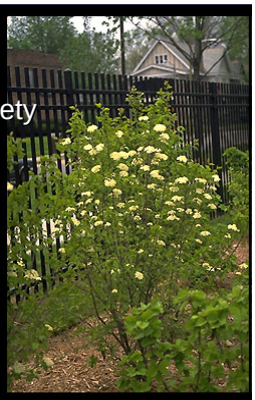

Coastal Plain

http://www.nps.gov/plants/pubs/chesapeake/img/icons/watershedmap.gif

www.lowimpactdevelopment.org/raingarden_design

Choices

- The templates have a variety of themes such as
  - Fragrance
  - Color focus
  - One nice tree
  - Butterflies
  - Birds
  - Screening… and more!
- Formal and informal arrangements


Viburnum prunifolium
Blackhaw Viburnum

Mountains

Piedmont

Coastal Plain

North Creek Nurseries

Coastal Plain-Low Maintenance & Deer Resistant-Sun

Vaccinium angustifolium 'Brunswick'

Low bush blueberry

Aster novae-angliae

Amelanchier 'Autumn Brilliance' (subst. for 'A')

Service Berry

Asclepias tuberosa

Butterfly weed

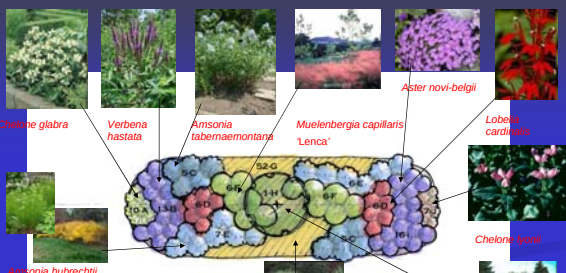
Clethra alnifolia 'Ruby Spice'

Summersweet

Solidago 'Golden Fleece'

Dwarf goldenrod

Butterflies



Chelone glabra

Verbena hastata

Amsonia tabernaemontana

Muelenbergia capillaris 'Lenca'

Aster novi-belgii

Lobelia cardinalis

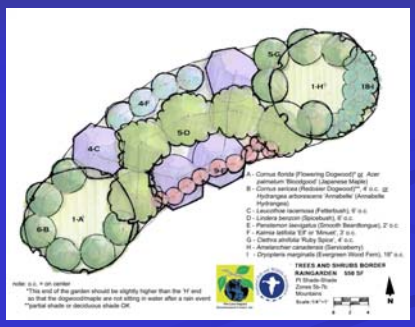
Chelone lyonii

Amsonia hubrechtii

Carex stricta

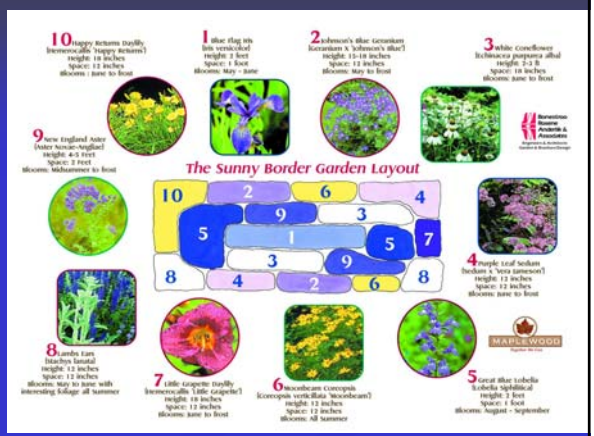
Magnolia virginiana

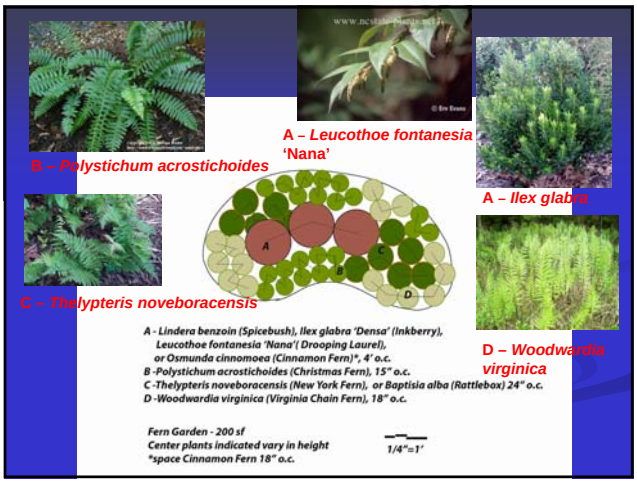
Trees and Shrubs Border

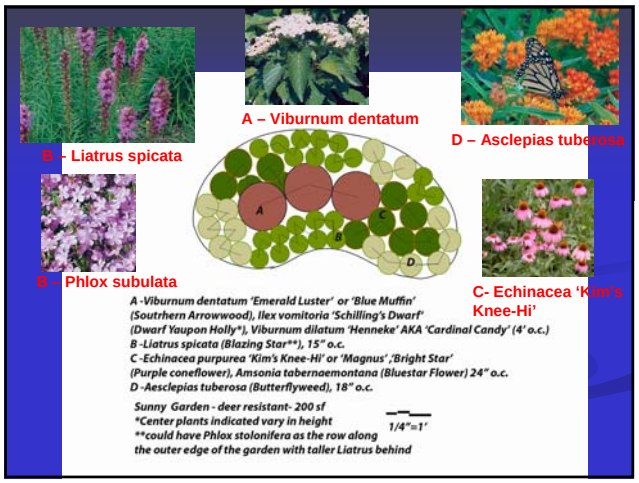


A Fragrant Formal Bed adapted for Shade (left) and Sun (right)

Template sources







Gardens Designed for Maintenance Ease

- Easy access to and around the garden
- Flow should enter the garden as sheet flow or should be slowed down prior to entry if coming in via a swale
- Deeply rooted vegetation that is adapted to the conditions

Diversity in plant choices

Viburnum spp.

Blackhaw

Maple-leaf

Arrowood

Serviceberry / Shadbush

Amelanchier canadensis

Silky Dogwood*

Cornus amomum

Common Elderberry

Sambucus canadensis

Buttonbush

Cephalanthus occidentalis

Winterberry

Ilex verticillata

Wild Ginger

Asarum canadense

Creeping Phlox

Phlox stolonifera

Marsh Marigold

Caltha palustris

Turtlehead

Chelone glabra

Cardinal Flower

Lobelia cardinalis

Great Blue Lobelia

Lobelia siphilitica

Swamp Milkweed

Asclepias incarnata

New England Aster

Aster novae angliae

New York Ironweed

Vernonia noveboracensis

Joe-pye Weed

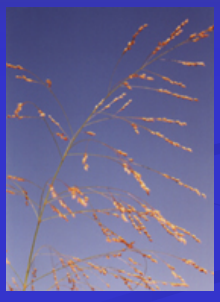
Eupatorium fistulosum (maculatum)

Goldenrod

Solidago spp.

Switchgrass

Panicum virgatum



Big Bluestem

Andropogon gerardii

Little Bluestem

Shizachrium scoparium

Online plant guides

Plant lists for each Province and for Sun and for Shade

Part Shade - Shade Plants for Rain Gardens
All plants used in Chesapeake Bay Provinces Templates

Pt Shade Shade PERENNIALS, GRASSES AND FERNS :

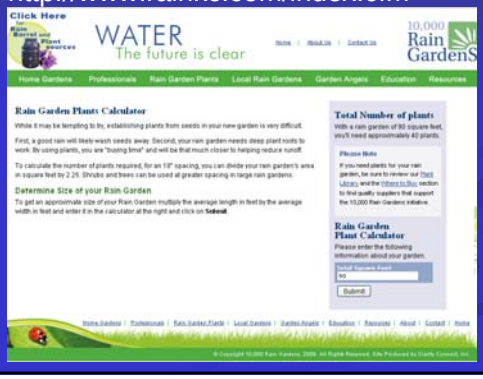
Ajuga reptans	Carpetbugle	Many cultivars, evergreen groundcover, purple flowers, up to 12" tall in flower, foliage hugs the ground
Amsonia tabernaemontana	Blue Star Flower	3' tall, medium texture, needs half day of sun to bloom best, yellow fall color
Aquilegia canadensis	Columbine	Reddish flowers, 12-18" tall, freely reseeds
Aralia racemosa	Spikenard	White flowering perennial
Arisaema triphyllum	Jack-in-the-Pulpit	Spring emerging, dramatic perennial, red fall fruit
Asarum shuttleworthii	Shuttleworth's Wild Ginger	Large billowing clouds of white, up to 8' tall
Asarum canadense	Wild Ginger	Deciduous groundcover, edge plant, heart-shaped leaves, up to 6" tall
Asclepias tuberosa	Butterfly weed	Bright orange summer flowers, Monarch butterfly larval food
Aster cordifolius	Blue Wood Aster	Blue fall flowers, fine texture, fairly shade tolerant
Aster divaricatus	White Wood Aster	Fine texture, white flowers, fairly shade tolerant, 18" tall, fall blooming
Aster ericoides	Heath Aster	White flowers, fall bloom, fine texture
Aster novae-angliae 'Purple Dome'	Purple Dome New England Aster	Compact fall flowering purple aster, habitat plant, up to half day of shade OK!
Astilbe 'Deutschland'	Perennial Spirea or White Astilbe	Late Spring/early summer upright fine texture white flowers, fern like foliage
Astilbe 'Rheinland'	Perennial Spirea or Pink Astilbe	Late Spring/early summer upright fine texture pink flowers, fern like foliage
Athyrium filix-femina ssp. asplenioides	Lady Fern	Fine texture, vertical structure,2' tall
Daphne alba	Fetterbon	White flowered form of Daphne, spring shoots look like black asparagus, half day of shade OK, needs excellent drainage
Carex pensylvanica	Sedge	Grassy foliage, yellow-green flowers, spreads
Chasmanthium latifolium	Upland sea oats	Grassy foliage, attractive seedheads all winter long, habitat plant
Cimicifuga racemosa	Black Cohosh , Black Snakeroot	White flowers, wand like appearance, 2-3' tall
Convallaria majalis	Lily of the Valley	Spring bulb, very fragrant white bell flowers, 8" tall
Dennstaedtia punctilobula	Hay scented Fern	Tolerant of dry and wet conditions, spreads

Low Impact Development Center

www.lowimpactdevelopment.org

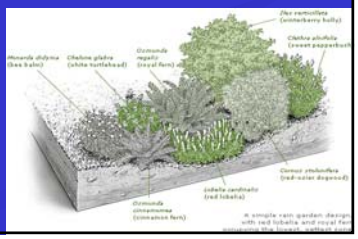
Plants Calculator

http://www.rainkc.com/index.cfm



Construction

Excavation
Soil amendment
Planting
Mulching
Watering



Garden Timing

- Add garden after other construction is finished
- Planting best done between November and April

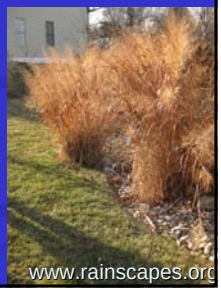
Backyard Rain Garden Construction

www.bae.ncsu.edu/stormwater

Maintenance and Inspection

- Check for settling, in the middle and around the edges – don't want to end up too deep
  - Edge problems – don't make side slopes too steep
- Watering to establish garden
  - Particular issue for Spring planting
- Weeding
  - Inevitable in the beginning
  - More dense planting will reduce problem
  - Careful selection of mulch source
- Periodic mulching
- Berm – check overflow area periodically and keep planted or mulched
- Inflow area – check for erosion, add stone if necessary

Design & Siting Issues in Montgomery County



QUESTIONS?

www.rainscapes.org

Rainscapes.application@montgomerycountymd.gov

ann.english@montgomerycountymd.gov
pamela.rowe@montgomerycountymd.gov
240-777-7700